

EXERCISE GENERATION TOOLSET (EXGEN)

Greg Schow, STRICOM
Rhonda Freeman, TASC
Harvey Meier, TASC
Jeff Swauger, TASC
12443 Research Parkway
Orlando, FL 32826

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ABSTRACT

The purpose of this paper is to detail the design approach and experiences of the Exercise Generation (ExGen) portion of the Distributed Interactive Simulation Exercise Construction Toolset (DISECT) program. The ExGen is intended to address the difficulties encountered in planning, setting up, and executing simulation exercises. ExGen is designed to simplify the task of a user in the performance of simulation exercises, and to work towards reducing or eliminating the need for computer science subject matter experts (SME's) to plan and perform routine training exercises.

Currently, the process of preparing for and conducting a simulation exercise requires the use of many different tools and platforms. There exists a need for an automated system based on a single, easy to understand user interface, whereby one user can sit down at one terminal and arrange the information and assets needed for the exercise, including what scenario is appropriate, what units and unit structures are applicable, what simulated entities are needed, and what files need to be generated to initialize the simulation assets to be used for the exercise. In addition, ExGen is designed to allow capture of information and scenarios that have proven useful for use in future exercises and applications, and to make these available to the user for easy incorporation into a simulation exercise.

1.0 INTRODUCTION

The DISECT Exercise Generation (ExGen) provides a toolset and working environment which will allow simulation exercises to be planned, setup, and executed faster, easier, and with greater efficiency than is currently possible. ExGen is focused on improving the ability of the user community to setup and conduct exercises which include the use of ModSAF as a constructive simulator. However, ExGen is designed with expansion to other simulator systems and platforms in mind. ExGen consists of two main functional products; the Simulation Object Repository (SOR) and Scenario Generation. Both of these functions combine to provide an Exercise Initialization capability for ModSAF based exercises.

The SOR provides a method of linking entity and unit data from various authoritative sources for use in a simulation exercise. Use of such data will increase the realism and utility of a simulation exercise when compared with the use of

generic entity or unit data, which is the method currently used in ModSAF. The SOR is designed with ease of use and expandability in mind. A World Wide Web based browser is used to query and communicate with the SOR. SOR can be thought of as a distributed, or "virtual" database, in that the data sources need not be collocated with the user or the SOR system. SOR is based on an object oriented database approach, where an object oriented database is used to query relational databases of authoritative data and cache the results temporarily for inspection by the user. This data can then be transferred to the user and passed on to ModSAF workstations to initialize the entity and unit data used for the exercise. ModSAF has been modified by the removal of all entity and associated rdr files, which significantly reduces the size of the ModSAF program. When loaded using SOR, only the entities used for the simulation being performed are loaded, which relieves the ModSAF station of the need to load and maintain large numbers of entities which are not pertinent to the simulation task at hand. The SOR also allows the user to browse the data for review and educational purposes.

Scenario Generation provides a method for easily generating, storing, and loading ModSAF scenarios. Scenario Generation is being implemented as an extension of the Army Training Exercise Development System (TREDS). Using the Scenario Generation tool, it is possible to create a scenario at a ModSAF workstation, transfer it to the PC used to run TREDS, add it to the list of scenarios TREDS stores which are linked with specific training objectives, and also select and load a scenario back to ModSAF to support a training exercise. Scenario Generation uses standard ftp protocols to allow transfer of scenario data over the Internet, local area networks, or by the use of transportable media such as floppy disks or tapes. By basing the system on an existing tool, TREDS, the need for the operator to learn a new user interface is eliminated. The ability to transfer files from ModSAF to and from TREDS means that information regarding the scenario and the scenarios themselves can be rapidly and efficiently transported back and forth between sites.

2.0 EXGEN

The ExGen portion of DISECT addresses the difficulties encountered in planning, setting up, and executing simulation exercises. ExGen simplifies the task of an Army user in the performance of simulation exercises, and reduces or eliminates the need for computer science and ModSAF subject matter experts (SME's) to plan and perform routine training exercises.

Currently, the process of preparing for and conducting a simulation exercise requires the use of many different tools and platforms. In fact, currently not all processes are automated, many aspects are done with the traditional "pencil and paper" approach. There exists a need for an automated system based on a single, easy to understand user interface. This will allow one officer in charge of performing a training exercise to sit down at one terminal and arrange the information and assets needed for the exercise, including what scenario is appropriate, what units and unit structures are applicable, what simulated entities (tanks, APCs, helicopters) are needed, and what files need to be generated to initialize the simulation assets for the exercise. The user needs information that directly relates to both the capabilities of the forces to be used and to official training doctrine for the task at hand. In addition, ExGen is designed to allow capture of information and scenarios that have proven useful

for use in future exercises and applications, and to make these available to the user for easy incorporation into a simulation exercise.

ExGen is designed as a proof-of-principle system with easy extensibility to allow support of Army requirements for future simulation planning and support. ExGen is also designed with attention to the requirement to generate simulation exercises for combat planning/rehearsal within a 96 hour timeframe. Without the use of automated tools such as ExGen, this goal will be extremely difficult to achieve.

2.1 Approach

Throughout the development of ExGen, the use of existing sources of information and simulation support tools has been given the highest priority. ExGen links to and enhances the capability of an existing tool in use by the Army for simulation and training exercise support. This approach minimizes the amount of new code and system development required, and also simplifies the use of ExGen by incorporating a familiar user interface. The use of intuitive graphical user interfaces (GUIs) is a high priority. In addition, the use of the Internet and associated systems such as the World Wide Web (WWW) have been evaluated and found to be an efficient method of information transfer and implementation of user interfaces. Details of the technical approaches for each of the aforementioned areas are described below.

2.2 Functional Design:

Figure 1 illustrates the functional design and implementation of the SOR. The design goal was to make the SOR a "virtual" repository of information. The task of taking over, maintaining, and performing configuration management on the sources of information to be used was not possible, either from ownership, political, or resource perspectives. Nevertheless, a method was found to link these sources of data to the end user in such a way that they may be easily accessed and used. Thus the concept of a virtual database. The SOR links to the various authoritative databases selected for incorporation, and will temporarily cache or store data in response to queries generated by the user. The actual sources of the data are not required to be collocated with the SOR. The implementation chosen does not require that the user be collocated with the computer system that hosts the SOR. This approach allows the organizations responsible for the base data to continue to maintain configuration management control and updates, and assures the end user that the most current data is available at any time. It also allows the user the greatest

degree of freedom in the use of the system, as the user and SOR may be separated by significant distances. The details of this architecture are presented in the following paragraphs.

2.2 World Wide Web

The design of the SOR relies heavily on the use of remote connections via the Internet and World Wide Web (WWW). The user interface to the SOR is provided by a hyper-text markup language (HTML) WWW page. This web page is hosted on a server that has access to or may even host the SOR system. The user queries the SOR for information about entities and unit structures via this interface, which then passes these requests on to the main SOR program. When the SOR has searched the appropriate databases and has collected the required information, it is passed back to the user for viewing and use via the same web interface. This approach provides an easy to use, highly adaptive and extensible interface for the user; one that is compatible with a wide variety of platforms. Most people are familiar with the WWW and its use, and web browser software packages (such as Netscape) are available for most platforms, including PC's, Macintosh's, and Unix workstations (including Sun and SGI platforms, such as those used to execute ModSAF). Following the query and search of the SOR databases, the returned data can be saved for future use on the user's system, or transferred to other computer systems, such as the actual ModSAF stations which will use the information, by such simple approaches as generic file transfer protocol (ftp) packages. This approach, using Internet and WWW connectivity, allows the SOR to be widely distributed and does not require users to come to a central facility. Internet connectivity is widely available, which allows the users to be widely distributed in geographic area. In addition, with Java applets and other unique Internet capabilities developed, the SOR is in an ideal position to take advantage of the rapidly evolving capabilities of the WWW. Furthermore, the use of a web based approach provides for a wide variety of display options for the information, including sophisticated multimedia tools.

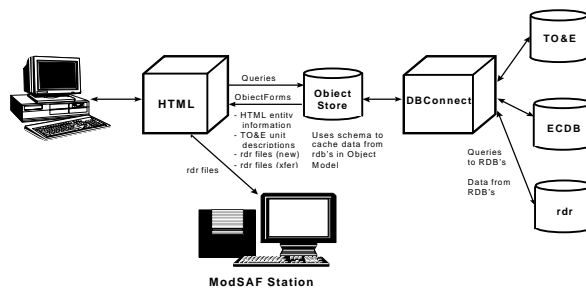


Figure 1- SOR Architecture

3.0 Scenario Generation:

A central aspect of the planning and execution of training and other exercises incorporating ModSAF as a supporting element is the generation and loading of an appropriate scenario into ModSAF. The scenario must support the training or other goals of the exercise, and should be easily transferred to the participating ModSAF stations for exercise initialization. ModSAF scenarios are usually generated using ModSAF itself as the tool for designing and storing scenarios. However, often the person planning an exercise may not have immediate access to a ModSAF station, or may not be proficient in developing scenario files using the ModSAF tool. Some method needs to be provided to allow such operations to be performed by trained ModSAF personnel at the direction of exercise planners, and to transfer the completed scenarios to a format and platform where they may be examined and evaluated by the exercise planner. Ideally this should be able to be accomplished over a long distance, so that planner and ModSAF station/operator do not have to be collocated. In addition, a method for collecting and storing ModSAF scenarios and the details of the specific exercise and training goals they address for future reuse is required. An exercise planner or officer setting up a training exercise should not have to regenerate scenarios that have already been implemented previously. The planner should be able to browse listings of available ModSAF scenarios and the training goals they support, select scenarios for use that support his or her goals, and transfer these scenario files to the ModSAF stations to be used for the exercise. Ideally this capability should be incorporated as an extension of an existing exercise support tool that already has acceptance and is in use by the Army. This would minimize the number of user interfaces and tools that the user community must be familiar with.

3.1 Functional Design:

The Scenario Generation component of ExGen provides the capabilities outlined above. Figure 2 illustrates a functional diagram of the Scenario Generation tool. Functionally, the application provides a vehicle for capturing ModSAF generated scenarios in an existing U.S. Army training tool, and in allowing ModSAF scenarios to be stored, examined, selected, and loaded into ModSAF workstations for exercise support. The tool chosen for integration with the Scenario Generation capability is the Army Training Exercise Development System (TREDS). TREDS offers great potential for supporting the scenario generation tasks of ModSAF. This system was developed as part of the Close-Combat Tactical Trainer (CCTT) program. It is an automated planning system for simulation exercises that covers all aspects from training objectives down to specific scenarios to use with ModSAF or Janus. The system is populated for battalions down to platoons. The system uses TPS (Task Performance System) codes to specify how well a particular simulation system trains individual tasks. This is used to come up with best fits between training objectives, simulations, and particularly individual scenarios. Scenarios include OPODS, overlays, execution matrices, and notes, and new scenarios can be added to the database. The overlays, which consist of maps and graphics, are stored in PowerPoint format.

Figure 2 - Scenario Generation Functional Diagram

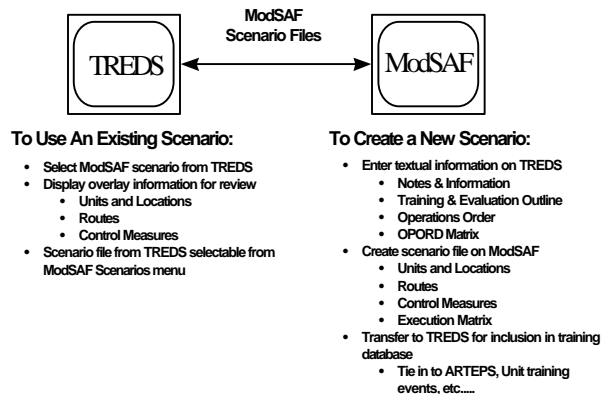


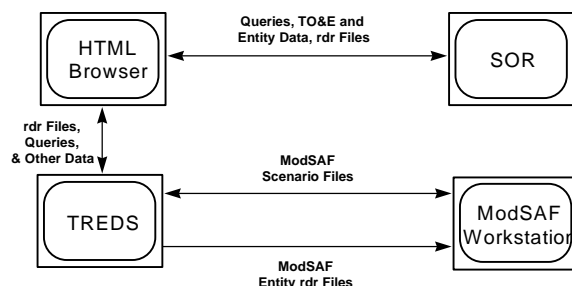
Figure 2 illustrates the relationship between TREDS and ModSAF. Scenarios may be generated in ModSAF and transferred into TREDS for evaluation

and storage. The user may also scan and select various ModSAF scenarios stored in TREDS for transfer to and use by ModSAF.

4.0 Exercise Initialization

Exercise initialization refers to the combined capabilities of the SOR and Scenario Generation applications to develop, load, initialize, and run a ModSAF exercise. Figure 3 illustrates the proposed linkage between SOR and Scenario Generation. As can be seen, TREDS is an ideal vehicle for integrating both aspects of the ExGen into a single unified tool. The ability of TREDS to launch various helper applications, such as the ModSAF overlay viewer and ftp program, makes it easily modifiable to launch a standard web browser (such as Netscape or Microsoft Explorer) to allow connection with the SOR. The HTML interface and/or the ftp application already developed is used to transfer the entity rdr files from the SOR to TREDS and on to the ModSAF station to be used in the exercise. This approach provides significantly increased capability to TREDS while still maintaining an existing, simple user interface that is currently in use with the Army training community. Using this approach, ExGen is enhancing TREDS into a total Exercise Initialization toolset with minimal technical risk and impact on the user.

Figure 3 - SOR/Scenario Generation



5.0 Summary

This paper has documented the functions of the DISECT Exercise Generation (ExGen) tools and the associated technical rationale for the decisions made. ExGen offers the capability to improve the planning and execution of simulation exercises by providing the exercise planner with a single, unified toolset.

The SOR portion of ExGen allows up to date and realistic information about simulation entities and military unit structures and composition to be used in

place of generic data. In addition, the removal of as many files from ModSAF as possible and loading only those entities that are relevant, reduces the computational requirements for ModSAF. The use of HTML and WWW capabilities allows the SOR to be accessed from remote locations and eliminates the need for the user to be collocated with the SOR, increasing flexibility.

Scenario Generation involves the incorporation of additional capabilities into the U.S. Army TREDs system to allow generation, storage, and retrieval of ModSAF scenarios. Scenarios may be developed on ModSAF workstations and transferred to TREDs for evaluation and comment. In addition, ModSAF scenarios can be stored in TREDs and tied to the training objectives they support for browsing and selection by the exercise developer/planner. Scenario files can be transferred via ftp over the Internet or local network, or may be moved via disk or tape. The use of TREDs, which is based on Microsoft Windows applications, provides an easy to learn, intuitive interface for the system. In addition, the use of TREDs as the interface to Scenario Generation functions will require significantly less training for operators to learn the system.

Exercise Initialization is the combination of the two capabilities, SOR and Scenario Generation. The nature of the above tools make them ideally suited for incorporation into a single generic interface, such as TREDs. These tools provide exercise planners and trainers with a unified, easy to use package which greatly increases the efficiency and ease with which a simulation exercise may be generated.